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(71) Applicant
Plough Inc.

(Incorporated in USA—Delaware)

3030 Jackson Avenue, Memphis, Tennessee 38151, United States of America

(72) Inventors
Harold Suss
James Edward Doyle

(74) Agent and/or Address for Service
Mathys & Squire,
10 Fleet Street, London EC4Y 1AY

# (54) Nail-strengthening cosmetic compositions

(57) A cosmetic composition comprises an amount of glyoxal sufficient to strengthen nails in admixture with a substantially non-aqueous conventional nitrocellulose-based nail lacquer preperation. The nail lacquers can be clear and colorless or can have pigments therein. The preferred amount of glyoxal is about 0.001 to about 1.00 weight percent of the composition.

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SPECIFICATION

**Neil strengthening compositione and method of using same**

This invention relates to cosmetic neil strengthening compositions. The compositions mey be cleer or colored with conventionel organic end inorgenic pigments. The invention elso contemplates a method of strengthaning neils by epplying tha inventive compositions to the neils.

Many users or would-be users of neil polieh have difficulty due to crackad, split or broken toe neils end finger nails. The cause of these conditions hes been ettributed to one of more of the following: tha use of nail polish and/or nail polieh removar, the use of soap or detergants, and/or e neturel idosyncrasy of the user.

Numerous neil preperetions have been mede which cleim to strengthen neils by the action of chamicels conteined in them. Nail hardening compositions in which the principal ective componant is formeldehyde in e concentration generelly renging from 4 to 15% heve been propoeed. See for exemple, U.S. Petent 3,382,151 (Knudein). However, the use of formeldehyde in cosmetics produces undesirable side effects, such as inflammation, hardening end/or formation of hom on edjacent skin erees. In addition, the formaldehyde has e rather dengerous toxic effect, especielly on the nerve cells of the skin end the capillariee. Accordingly, the U.S. Food end Drug Administretion considers eny solution which conteine more than 4% formeldehyde to be "e poisonous or deleterious substance."

Numerous nail strengtheners heve been proposed to ovarcome the problems essociated with using formaldehyde.

UK Petent 1,183,513 (issued Merch 11, 1970) disclosas compositione for traeting neils conteining one or more mono-aldehydes conteining et leest two carbon etoms or polyeldahydes conteining more then two carbon etoms. U.S. Petents 3,349,000 end 3,725,525 disclose that use of the reection product of formeldehyde with thiouree imperts to native keratins, e.g., neils, higher alasticity and strangth then do frae aldehydes without producing eny undasirabla side effects. U.S. Patent 382,151 disclosas tha use of e neil atrengthaning composhion conteining e high concentretion of formeldehyde modified by vageteble extrects.

French Petent 1,485,602 (Morelle) discloses neil polish composhions conteining equaoue aolutions of glyoxal in combinetion with ecylated protein derivetives.

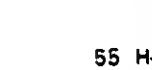
U.S. Petents Nos. 4,296,104, 4,296,130 end 4,447,469 disclose neil conditioner end neil polish compositions conteining glyoxel, high concentrations of weter in admixture with methylsulfonylmethane (MSM), dimethylsulfoxide (DMSO) and cerbimide or urea. Howevar, MSM is disclosed as the activa ingradiant and DMSO is described as eccelarating the panatration of MSM end uree or carbimida into the tough nail meteriel.

U.S. Patents Nos. 4,256,768 end 4,569,946 disclose topicel epplicetion of dilute eqaeous or elcoholic solutions of lower dialdahydes such es glyoxel to humen tissua for traatment of gengrane, burns and rew, cut portions of the body during surgical axcision of melignant tumors. Nothing regarding nail strengthening compositions is recited.

There is a naad for e nail strengthening composition thet operetes to strengthen nails efficiently and safely without ceusing the undesirebla sida affects experienced with prior art compositions.

The present invention is summarized es e cosmetic composition for strengthening neils comprising en emount of glyoxel effective for strengthening neils in e subetentielly non-aqueous conventional nitrocellulose-based neil lecquer preperetion. The invention elso provides e method of strengthening the neils which comprises epplying to the neils e cosmetic composition comprising en emount of glyoxel sufficient to strengthen seid nails in edmixture with e substentielly non-eqaeous convantionel nitrocellulose-besed nail lecquer preparetion, which praparetion may be colorless or colorad with conventional neil polish orgenic end inorgenic pigments.

Glyoxel is e dieldahyde heving the formule



end is commercielly availeble ae e 40% aqueous solution which aleo conteins e polymerization inhibitor. Vecuum eveporetion of the eqaeous glyoxel solution leeds to polyglyoxel, e trimer of glyoxel. Thermel depolymerizetion of polyglyoxal in the presence of drying egante yields unsteble enhydrous monomeric glyoxel which must be used immedietely. See for exemple G. Mattioda, et el., CHEMTECH. August 1983 pp. 478–481. Thus, while aqueous or enhydrous glyoxel may ba used in the compositions and procass of the presant invention, the use of 40% aqueoua glyoxal solutions is mora conveniant.

As used throughout the present specificetion and cleims, all percentages ere weight percente unless steted otherwise.

Percentages of "glyoxal" in the compositions are based a 40% aqueous glyoxal solution, hence to obtein the percentage of dry glyoxal, multiply eech percentage of "glyoxel" by 0.40. Of course the claims are intended to cover composnions prepared using solutions of glyoxal heving different concentrations when said compositions contain the seme amount of glyoxel on e dry basis.

The amount of glyoxel in the cosmetic composition of the present invention found effective for strengthening nails when added to a substantially non-aqueous conventional nitrocellulose-based nail lacquer preparation is about 0.001 to about 1.0 weight percent, preferably about 0.001 to about 0.25 weight percent, more preferably about 0.01 to about 0.25 weight percent of the cosmetic composition. 8y employing these emounts of glyoxal in seid neil lacquer preperation in accordance with the present invention, nail strengthening is effected without the deleterious side effects associeted with prior art formeldehyde-containing preparations.

The term "substantially non-aqueous" as used herein means less then ebout 1 weight percent water. With the exception of the small amount of water introduced by addition of glyoxal as e 40% aqueous glyoxal solution, no water should be intentionally added in the preperation of the cosmetic compositions of the present invention. However, the solvents end other components of the conventionel nitrocellulose-based nail lacquer preparetions need not be completely enhydrous for use in the cosmetic compositions and process of the present invention, provided the final composition is substantially non-aqueous as defined in this peragraph.

Conventional nitrocellulose-besed neil lacquer preperations heve been found useful in the present invention. Typical suitable conventional nitrocellulose-besed neil lacquer preperetions include:

Nitrocellulose (7–25%, more preferably 10–18%, and most preferably 12–16%),
secondery resins (5–15%),
plasticizers (2–8%), and
solvents (55–80%, more preferably 60–80%).

Other optionel ingredients include:

Thickening and suspending agents,
UV light masking and sunscreening agents,
Colorants, and
Decorative materials.

Nitrocellulose is the primary film-former used in the typicel neil lacquer preperetion end should have a viscosity value (R/S Value) of from 1/4 to 5/6 seconds (enebling the menufacture of cosmetic nail strengthening compositions that flow reedily end are cepeble of producing e film with sufficient gloss in one application), and be perfectly neutrel, for free acid mey damege the finger nail and destroy the pigments used in tinting the nail lecquer preparetion.

Typical suitable secondery resins compatible with nitrocellulose include most natural resins such as 8enzoin, Oammar, Ester gum, Pontienac Sandera or Shellac and any synthetic resin such as the alkyd, acrylate- and methecrylete-based resins, polyester resins (Lipo Rez resins) and formaldehyde sulfonemide resins (Santolite resins). Santolite resin in combination with acrylate copolymer resins, is a preferred secondary resin. Other secondary resins include: nylon, availeble under the tradeneme of Versamid 930 from Henkel, Inc., Teaneck, NJ 07666, acryletes copolymer resins, aveilable from Rhom and Haas Co., Philadelphia, PA 19105, under the tradeneme of Acryloid 8-66, end styrene/acrylate/acrylonitrile copolymers, aveilable from Oow Chemical U.S.A., Midland, MI 48640.

Typical suitable plesticizers include blown castor oil, camphor, rew castor oil, dibutyl phthalete and tricresyl phosphate. Use of a combination camphor end et leest one or two other plasticizers, normally dibutylphthelate and/or sucrose ecetete isobutyrete is conventionel.

UV light masking agents used in clear nail laquer compositions to mesk the yellow color caused by discoloretion of the nitrocelluose resin include pigments such es 0&C Violet #2.

Typical suiteble sunscreening egents include esters of pere-eminobenzoic acid and substituted pera-eminobenzoic acid, e.g., octyl dimethyl PA8A; certein esters of selicylic acid, e.g., homomethyl salicylate; certein benzophenone derivatives, such es benzophenone-1 or -3; and the esters of pera-methoxycinnamic acid, e.g., octyl methoxycinnamate.

The compositions of the present invention may also include thickening and suspending agents for the colorants. Typical suitable thickening and suspending agents include stearalkonium Hectorite, a reaction product of Hectorite (one of the montmorillonite minerals that are the pnncipal constituents of bentonite clay) and stearalkonium chloride [a quarternary ammonium salt of the formula,

$$[CH_3(CH_2)_{16}CH_2-\overset{+}{N}-(CH_3)_2-CH_2-C_6H_5]\overset{-}{Cl}.$$

Typical suitable decorative meteriels include aluminum polyester terephthelate, aveilable under the tradename 8ril Chrome Silver from Meadowbrook Inventions, Bernardsville, NJ 07924; ecrylates copolymer end polybutene terephthelate and ethylene/vinyl acetate copolymer available under the tradeneme Crystelina from Meadowbrook Inventions; Silver aveilable under the tradename 5ilver from Presperse, Inc. So. Plainfield, N.J. 07080; decorativa pearl aveilable under the tradename Meerlmaid from Mearl Corp. NY, NY 10017; mica; titanium dioxide coeted mica; bismith oxychloride and guanine.

The aolvent combination found suitable in conventional nitrocellulose-based nail lacquer preparations consists of an alcohol, such as ethanol or iso-propyl alcohol which is used to wet the nitrocellulose, together with an ective solvent such as n-, sec- or iso-butyl acetete or ethyl acetete and en eromatic hydrocarbon diluent such as toluene or xylene. Other typical suitable solvents are found on pages 991–994 of "Nail Preparations" by Henry J. Wing, Chapter 49, pp. 983 to 1110, in "The Chemistry and Manufacture of Cosmetics", Second Edition, Volume IV edited by M. G. deNavarre, Continental Press, 1975, Orlando, Florida which is hereby incorporated by reference.

The conventionel nitrocellulose-based nail lacquer preperetion mey be clear or colorless, i.e. unshaded or sheded. The shaded product may contain insoluble organic and inorgenic coloranta together with small proportions of titanium dioxide. The orgenic colorante ehould be selected from an FOA approved list of certified pigments end dyes; the inorganic pigments should conform to the FOA specifications with respect to heevy metel content. A listing of the opaque and transparent colorants is given on pp. 997–998 of "Neil Preparations" cited hereinabove.

The process of the present invention coneists of strengthening finger or toe nails, by applying to the surface thereof using e conventionel nail polish applicator, a cosmetic composition such as described above or in the examples.

The following examples further describe end illustrate formulation of representetive unsheded and shaded nitrocellulose-based nail lecquer preparations. All of the mixing operations of the examples were parformed at room temperature.

The nitrocellulose wes obtained from Hercules, Inc., Wilmington, OE 19899; the toluene sulfonamide/formaldehyde resin tradenamed Sentolite resins from Monsanto Chemical Co., 5t. Louis, MO 63116; benzophenone-1 is a UV sunscreening egent from BA5F Wyendotte Corp., Parsippeny, NJ 07054; isosteeric hydrolyzed animal protein is a conditioning egent aveileble under the tradename Crotein IPX from CROOA, NY, NY 10010; polyester resins available under the tradename Lipo Rez resins from Lipo Chemicels, Inc. Peterson, NJ 07504; and stearalkonium Hectorite is a thickening and suspending egent evaileble from NL Chemicels Oivision of NL Industries, Highstown, NJ 08520.

The suppliers of other ingredients used in the following illustrative exemples are well known end can be found. e.g. in CTFA Coemetic Ingredient Dictionery, Third Edition, 1982, N.F. Estrin et al., eds., published by The Cosmetic, Toilatry and Fragrance Associetion, Inc., 1110 Vermont Avenue, N.W., Washington, O.C. 20005.

*EXAMPLE 1*
*Colorless Nail Lacquer Composition*

| *Ingredient* | *Weight %* |
|---|---|
| Butyl Acetate | 26.00 |
| Toluene | 20.00 |
| Nitrocellulose R/S 1/2 sec. | 14.00 |
| Isopropyl Alcohol | 5.00 |
| Toluene Sulfonamide Formaldehyde Resin | 10.00 |
| Ethyl Acetete | 19.599 |
| Camphor | 0.50 |
| Benzophenone-1 | 0.10 |
| Nylon | 0.10 |
| Acrylates Copolymer | 0.10 |
| Sucrose Acetete Isobutyrate | 4.00 |
| Polyester Raain | 0.50 |
| Glyoxal | 0.001 |
| O&C Violet No. 2, (0.01% solution | 0.10 |
| Totel | 100.000 |

To e stainless steel kettle equipped with a high sheer stirrer, cherge the toluene, toluene sulfonemide/formaldehyde resin, butyl acetate and ona half of the ethyl ecetete end stir until a homogeneous mixture is formed. Continue to stir and slowly edd to the mixture the nitrocellu-

lose, benzophenone-1, camphor and sucrose ecetete isobutyrete. To the stirred homogeneous mixture so formed, edd nylon, ecrylates copolymers, polyester resin and continue stirring until a homogeneous mixture is reformed. Continue stiring end add the isopropyl alcohol, D&C violet #2, remaining helf of ethyl ecetete, end glyoxel. Fill into bottles.

*EXAMPLE 2*
*Colorless Nail Lacquer Composition*

| *Ingredient* | *Weight %* |
|---|---|
| Butyl Acetate | 18.26 |
| Toluene | 25.40 |
| Nitrocellulose R/S 1/2 sec. | 14.00 |
| Isopropyl Alcohol | 1.00 |
| Toluene Sulfonemide Formeldehyde Resin | 10.00 |
| Oibutyl Phthelete | 4.00 |
| Ethyl Acetete | 25.60 |
| Camphor | 0.99 |
| Benzophenone-1 | 0.10 |
| Nylon | 0.10 |
| Acrylates Copolymer | 0.10 |
| Glyoxel | 0.25 |
| D&C Violet No. 2, (0.01% solution) | 0.10 |
| Isostearic Hydrolyzed Animal Protein | 0.10 |
| .Totel | 100.000 |

Following the procedure of Example 2 except edd the dibutylphthalate to the mixture containing nitrocellulose and add the isostearic hydrolyzed animel protein to the mixture conteining nylon.

*EXAMPLES 3 AND 4*
*Colored Nail Polish*

| *Ingradiants* | *Weight % Exampla 3* | *Exemple 4* |
|---|---|---|
| *Part A* | | |
| Toluane | 25.10 | 25.45 |
| Toluene 5ulfonamida/Formaldahyda Rasin | 9.00 | 0.05 |
| Butyl Acetate | 25.33 | 25.66 |
| *Part B* | | |
| Nitrocallulosa R/5 1/2 sac. | 14.00 | 14.00 |
| Staaralkonium Hactorita | 1.30 | 1.30 |
| Banzophanona-1 | 0.10 | 0.10 |
| Oibutyl Phthalata | 2.50 | 0.05 |
| Camphor | 2.00 | 2.00 |
| Polyastar Rasin | 2.50 | 10.00 |
| 5ucroaa Acatata Isobutyrata | 2.50 | 2.50 |
| *Part C* | | |
| Nylon | 0.10 | 0.10 |
| Acrylatas Copolymar | 0.10 | 0.10 |
| Styrana/Acrylata/Acrylonitrila Copolymar | 0.05 | 0.05 |
| *Part D* | | |
| Ethyl Acatata | 4.00 | 5.00 |
| Isopropyl Alcohol | 10.00 | 10.00 |
| Butyl Alcohol | 1.00 | 3.00 |
| SD-Alcohol-3A | 0.05 | 0.05 |
| Glyoxal | 0.01 | 0.01 |
| *Part E* | | |
| Titanium Oioxida | 0.20 | 0.04 |
| D&C Rad No. 7 Calcium Lake | 0.05 | 0.09 |
| Iron Oxidas | 0.08 | 0.05 |
| D&C Rad No. 6 Barium Lake | 0.02 | 0.20 |
| Farric Ammonium Ferrocyanida | 0.01 | — |
| Bismith Oxychlorida, 11% | — | 0.20 |
| Total | 100.00 | 100.0 |

To an appropriate steinlass staal kettla aquippad with a high sheer stirrer, charga the ingrediants in Part A and stir until a homogaaous mixtura is formad. 5lowly add to the so formed mixture tha ingradients in Part B. Stop stirring and covar kettla to prevant evaporation of solvents and hold so formad homogaaous mixture for 10 hours. Ramova cover, stir and add tha ingradianta of Part C. To tha so formad homogaaous mixture, add tha ingrediants in Part D. To the homogeneous mixture so formed add the ingrediants in Part E and stir until a homogeneous mixtura is formed.

CLAIM5

1. A coamatic composition for strengthening nails comprising an amount of glyoxal affactive for strengthaning nails in a substantially non-aquaous convantional nitrocallulosa-based nail lacquar praparation.

2. The composition of claim 1 containing from 0.001 to 1 parcant glyoxal.

3. Tha composition of claim 2 containing from 0.001 to 0.25 parcant glyoxal.

4. Tha composition of any one of claims 1 to 3 wharain tha sub-stantially non-aqueous conventionel nitrocellulosa-based nail lacquer comprisas.

(a) 7 to 25% nitrocallulosa,
(b) 5 to 15% saconday rasins,
(c) 2 to 8 plasticizers, and
(d) 55 to 80% solvants.

5. A mathod of strengthaning nails comprising applying to tha nails the compoaition of anyona of claims 1 to 3.

6. A mathod of strangthening nails comprising applying to the naila the composition of claim 4.

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